THE CRUSHED STONE JOURNAL

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The National Crushed Stone Association

In This Issue—

Some Researches and their Practical Application

Trade Association Activities in the Development of Ethical Standards

Stone Sand—Its Successful Use and Characteristics

The Importance of Proper Specifications for Crushed Stone

MARCH, 1930

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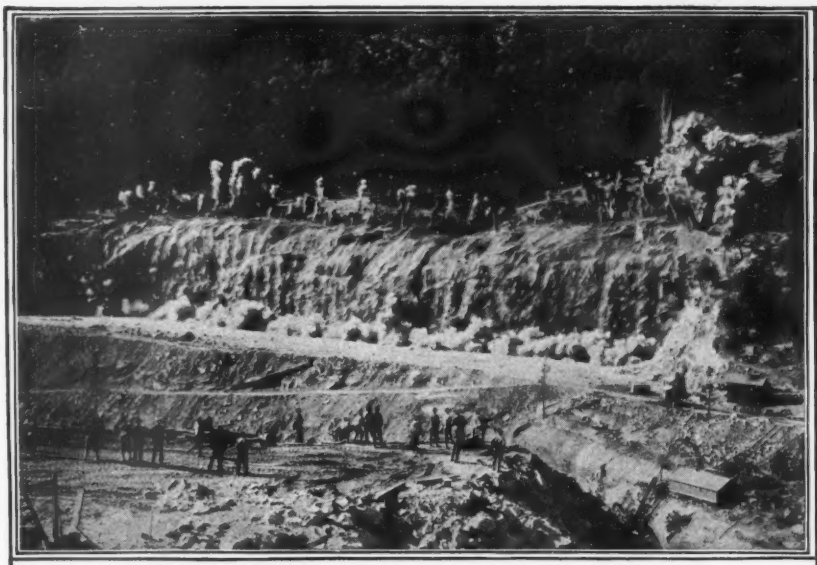

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The CRUSHED STONE JOURNAL

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Some Researches and their Practical Application

BY A. T. GOLDBECK, *Director,*

Bureau of Engineering, National Crushed Stone Association

IT will be recalled that during the past year, several papers have been published in *The Crushed Stone Journal*[1] dealing with concrete tests. In these investigations various crushed stone and gravel aggregates have been used and the materials employed have had a wide range of characteristics, varying from extremely hard to very soft and brittle material; from rounded, polished pebbles to angular, rough crushed stone.

In the March, 1929, issue of the *Journal* under the title, "Tests on Crushed Stone Concrete," were published the results of compression and beam tests made on concrete having like volumetric proportions of 1:2:3½ in all cases. This was a preliminary series of tests to determine the relative strengths to be expected from materials having widely different characteristics. It was not at all the object of these tests, as some readers seemed to think, to compare crushed stone as a class with material which is classified as gravel, for it always has been recognized by the writer that under both of these general classifications are aggregates which differ widely in their characteristics. Both include materials of high and also of poor quality. The results of these original investigations were very enlightening in demonstrating that a wide difference in results, both in compression and in cross-bending is obtained when different aggregates are used in concrete, proportioned with like arbitrary proportions.

They also were very encouraging to the producers of angular coarse aggregates in showing that, as a general rule, the crushed stone concretes seemed to have higher cross-breaking resistance than the gravel concretes. In some cases the differences were quite pronounced. In others, there was too little difference to consider.

There was another outstanding fact developed, namely, that with like arbitrary proportions, the angular aggregates required more cement per cubic yard of concrete than the rounded aggregates. The results of these tests are tabulated herewith for the sake of completeness. (See Table 1.)

High Points in the Paper

The present paper describes the third group of a series of tests made to develop a method for the design of concrete having a required beam strength. As a result of this series, a method of design has been successfully evolved by means of which it is now possible to proportion concrete with the particular aggregates selected, so that it will have the beam strength desired. The method is simple and requires the testing of a preliminary trial batch of concrete containing the aggregates to be used on the work. From the beam strength of this trial batch, the correct water-ratio for the desired beam strength is determined. Finally, a second trial batch, having the correct water-ratio is used to obtain the batch weights.

The next logical step in our efforts to develop a method for the design of concrete having equal beam strength was to make a series of tests using identically the same aggregates as before, but this time, instead of using the old arbitrary proportions of 1:2:3½, the concrete was designed so that in all cases, as closely as possible, 6.3 bags of cement per cubic yard of concrete were used. The method of obtaining the amount of coarse aggregate for the mixture was to use a value for $\frac{b}{b_o}$ equal to 0.775.[2] Having determined to use 6.3 bags of cement per cubic yard of concrete, the quantity of sand and water necessary to create the desired workability (165 flow and 1 to 2-inch slump) was obtained by trial batches. The details of this portion of the investigation have been described in the June, 1929 issue of the *Journal*, in a paper entitled, "Further Tests on Crushed Stone and Gravel Concrete." The table of

[1] Issues of March and June, 1929.

[2] See University of Illinois Bulletin No. 137, "The Strength of Concrete, Its Relation to the Cement, Aggregates and Water," by A. N. Talbot and F. E. Richart.

Table I.—Showing Properties of Concrete, with Different Coarse Aggregates, Graded as Received. Proportions 1:2:3½—Dry, loose, volume. Age—28 Days—Cured in Moist Room. Slump—Approximately 1½".

No.	Coarse Aggregate	Water Ratio	Flow	Wt. Unhardened Concrete, Lbs. per Cu. Ft.	Bags Cement per Cu.Yd.	Compressive Strength	Mod. of Rupture
2	Stone	0.81	163	151.4	6.16	3760	703
3	Gravel	0.88	165	142.4	5.86	3630	558
5	Stone	0.83	165	156.6	6.34	3670	674
6	Gravel	0.84	167	150.6	5.77	3450	535
7	Stone	0.88	161	148.4	6.08	4300	720
8	Gravel	0.85	162	151.4	5.78	3960	678
9	Stone	0.86	164	149.8	5.94	3600	640
12	Gravel	0.85	167	147.6	5.89	3500	599
13	Stone	0.88	162	147.0	6.13	3800	666
17	Gravel	0.81	164	148.4	5.82	3360	555
23	Stone	0.85	165	149.2	6.01	3810	717
24	Gravel	0.81	165	153.6	5.89	3960	679
27	Stone	0.84	168	152.0	6.00	3680	686
28	Gravel	0.88	168	147.6	5.59	3440	535
29	Gravel	0.83	171	147.4	5.77	3840	622
32	Stone	0.86	161	147.8	5.88	3370	638
31	Gravel	0.86	164	148.0	5.63	3160	517
35-1	Stone	0.80	169	153.8	6.13	3620	701
35-2	Stone	0.81	170	152.6	6.09	3770	712

results from this paper is included herewith and as has been previously pointed out, there is still a wide difference in the strengths of various concretes with different aggregates, all containing the same amount of cement per cubic yard. The crushing strengths are all uniformly high but this same statement cannot be made for the modulus of rupture. (Table II.)

It is outstanding from the results of this series of tests that weak coarse aggregates and those which have rounded, polished surfaces most certainly have an appreciable effect in decreasing the modulus of rupture or beam strength of concrete. From the results of this series the indications were very strong that, where such aggregates are used, it is necessary to redesign the concrete with more cement in the mixture to compensate for the deficiency in strength produced by the weak particles or by the lack of bond between the mortar and the coarse aggregate.

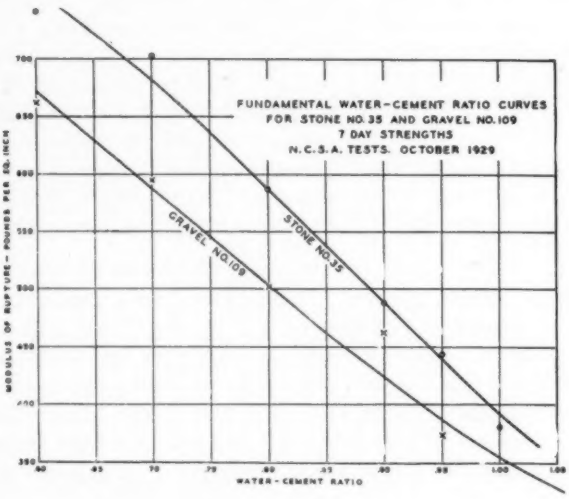
FUNDAMENTAL WATER-CEMENT RATIO CURVES
FOR STONE NO. 35 AND GRAVEL NO. 109
7 DAY STRENGTHS
N. C. S. A. TESTS. OCTOBER 1929
GRAVEL NO. 109
STONE NO. 35
MODULUS OF RUPTURE - POUNDS PER SQ. INCH
WATER - CEMENT RATIO

FIG. 1

As a third step in the operation of arriving at a method for designing concrete to have a given beam strength, the following procedure was undertaken. There is a well established law applying to the compressive strength of concrete. This law, in a general way, states that the compressive strength, when other conditions remain alike, is a function of the ratio of volume of water to volume of cement in the mixture. This is another way of saying the wetter the mix, the lower the strength and vice versa. It is the well established Abrams' water-cement ratio law.

By stating that there is a law involving compressive strength and water-cement ratio is not equivalent to saying that the relation of strength to water-ratio for all aggregates may be represented by a single curve, for this is not the case. But a series of curves, each one representing the water-cement law for concrete containing particular aggregates will be more or less parallel and in many cases will be quite close to one another.

It was assumed that if there is a relation between compressive strength and water-cement ratio for given aggregates, it should also be possible to express a relation between modulus of rupture and water-cement ratio. Accordingly, one of the first steps in the third part of the investigaton was to determine the shape of the modulus of rupture—water-cement ratio curves for two aggregates, one a crushed stone and the other a siliceous gravel. The curves showing this relation are given in Fig. 1. It was proposed to use these curves to determine the proper proportions to use with various coarse aggregates by the following procedure:

(a) Making trial batches of concrete with these coarse aggregates, using an assumed water-cement ratio.

(b) Making strength tests to determine the strength of these trial batches.

(c) Plotting the values for modulus of rupture thus obtained and through the points thus plotted drawing independent water-cement ratio—modulus of rupture curves parallel with the curves shown in Fig. 1.

Table II.—Showing Properties of Concrete with Different Coarse Aggregate Graded as Received. Approximately Same Cement Content and Same Consistency. Age 28 Days. Cured in Moist Room.

No.	Coarse Aggregate	Proportions Dry Loose Volume: Cement	Sand	Coarse Aggregate	Cement Bags per cu. yd.	Corrected W/C	Slump	Flow	Compressive Strength lbs. per sq. in.	Modulus of Rupture lbs. per sq. in.
35	Stone....	1	1.99	3.33	6.27	0.77	1.5	172	4490	768
2	Stone....	1	1.99	3.33	6.30	0.78	1.75	176	4300	745
3	Gravel...	1	1.67	3.43	6.33	0.69	1.5	159	4750	633
5	Stone....	1	2.19	3.29	6.28	0.83	1.25	169	4030	715
6	Gravel...	1	1.66	3.32	6.30	0.71	2.25	170	4310	607
7	Stone....	1	1.92	3.32	6.32	0.77	1.5	164	4890	755
8	Gravel...	1	1.69	3.31	6.30	0.70	2.0	168	5020	786
9	Stone....	1	1.83	3.30	6.28	0.79	1.25	159	4170	647
12	Gravel...	1	1.79	3.31	6.30	0.77	1.5	163	4360	650
13	Stone....	1	1.92	3.36	6.34	0.78	2.0	164	4890	760
17	Gravel...	1	1.73	3.32	6.30	0.68	2.0	164	4610	642
23	Stone....	1	1.87	3.32	6.31	0.78	1.75	162	4790	759
24	Gravel...	1	1.79	3.34	6.28	0.69	2.0	165	4850	707
27	Stone....	1	1.92	3.28	6.30	0.80	1.5	166	4480	769
28	Gravel...	1	1.51	3.36	6.32	0.71	1.5	160	4720	626
29	Gravel...	1	1.71	3.33	6.31	0.70	2.0	166	4730	704
32	Stone....	1	1.79	3.41	6.27	0.77	1.75	163	4660	690
31	Gravel...	1	1.57	3.41	6.27	0.70	1.5	163	4240	531
28–1	Gravel...	1	1.60	3.24	6.32	0.73	1.75	164	4480	613
31–1	Gravel...	1	1.64	3.29	6.29	0.72	1.75	160	4060	587
35	Stone....	1	1.98	3.29	6.30	0.76	1.75	164	4580	770

Our coarse aggregates, as before stated, were of widely varying characteristics and widely different gradations.

It does not seem to be fully recognized that if like workabilities are to be obtained in concrete having

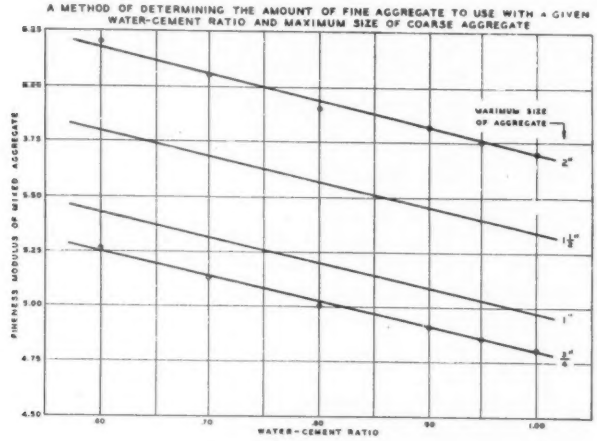
A METHOD OF DETERMINING THE AMOUNT OF FINE AGGREGATE TO USE WITH A GIVEN WATER-CEMENT RATIO AND MAXIMUM SIZE OF COARSE AGGREGATE
FINENESS MODULUS OF MIXED AGGREGATE
WATER-CEMENT RATIO
MAXIMUM SIZE OF AGGREGATE
2"
1½"
1"
¾"

FIG. 2

widely different water-cement ratios, it is quite necessary that the ratio of fine to coarse aggregates in the mix be altered. It became necessary, therefore, to determine some reasonable law to use in proportioning the ratio of fine to coarse. It seemed best to rely on our judgment of like workabilities to determine the

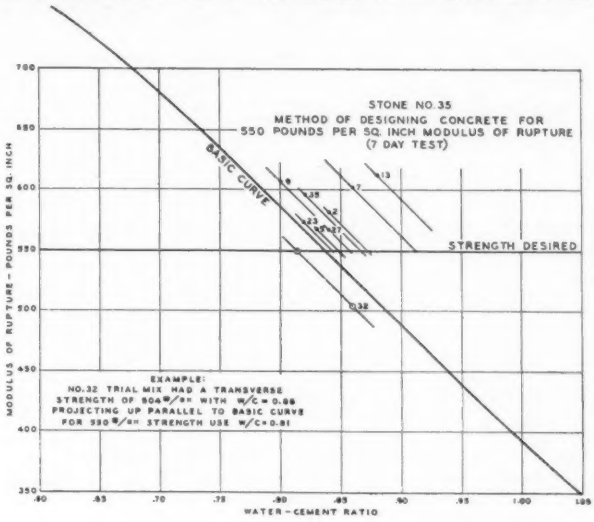
STONE NO. 35
METHOD OF DESIGNING CONCRETE FOR
550 POUNDS PER SQ. INCH MODULUS OF RUPTURE
(7 DAY TEST)
BASIC CURVE
STRENGTH DESIRED
EXAMPLE:
NO. 32 TRIAL MIX HAD A TRANSVERSE
STRENGTH OF 504 #/in² WITH w/c = 0.68
PROJECTING UP PARALLEL TO BASIC CURVE
FOR 550 #/in² STRENGTH USE w/c = 0.61
MODULUS OF RUPTURE - POUNDS PER SQ. INCH
WATER-CEMENT RATIO

FIG. 3

right ratio of fine to coarse. Six batches of concrete were made up using two-inch maximum size stone and having water ratios varying from low to very high. The sand content and the consistency of the cement paste were so regulated in each of these mixtures that identical workabilities were obtained in all cases, according to the judgment of the operators, supplemented by flow tests. The results are shown in the top curve in Fig. 2.

A like procedure was adopted with ¾ inch siliceous gravel and the results are shown in the bottom curve of Fig. 2. The intermediate curves for 1 inch and 1½ inch aggregates were established by interpolation.

The curves in Fig. 2 were useful in determining the amount of fine aggregate to use with a given water-cement ratio and a given maximum size of coarse aggregate, making use of the equation:

$$r = \frac{m_c - m}{m_c - m_f}$$

where

r = per cent of fine aggregate in the mixture of fine and coarse.

m_c = fineness modulus of coarse aggregate.

m = fineness modulus of mixture.

m_f = fineness modulus of fine aggregate.

With this information at hand, trial batches were made up for the various crushed stones and gravels

using water-ratios assumed on the basis of our previous work with these materials.

In Fig. 3 are shown the test results obtained for the

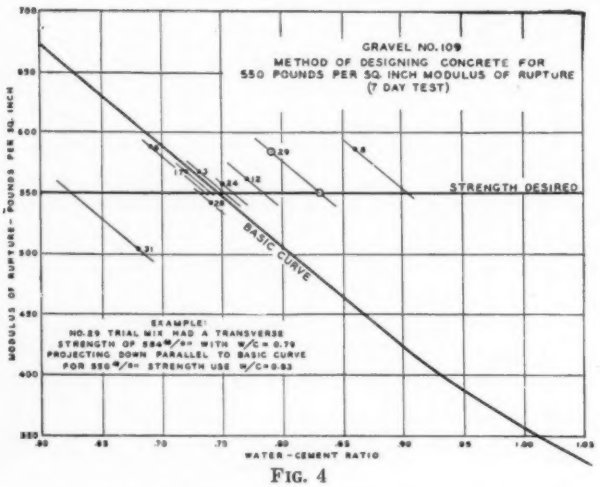
GRAVEL NO. 109
METHOD OF DESIGNING CONCRETE FOR
550 POUNDS PER SQ. INCH MODULUS OF RUPTURE
(7 DAY TEST)
STRENGTH DESIRED
BASIC CURVE
EXAMPLE:
NO. 29 TRIAL MIX HAD A TRANSVERSE
STRENGTH OF 554 #/in² WITH W/C = 0.79
PROJECTING DOWN PARALLEL TO BASIC CURVE
FOR 550 #/in² STRENGTH USE W/C = 0.83
MODULUS OF RUPTURE - POUNDS PER SQ. INCH
WATER - CEMENT RATIO

FIG. 4

various crushed stone coarse aggregates and in Fig. 4 are shown the results for the gravel coarse aggregates. Curves were drawn through the 7-day strength results thus plotted parallel to the basic water-cement ratio curves obtained from Fig. 1. Where these curves intersected a horizontal line drawn through the modulus of rupture value of 550 lbs. per sq. in., the necessary water-ratios were read off. Concrete specimens were again made up with these water-ratios and these were tested at 7 and 28 days.

A complete tabulation of the test results follows in Table III and these results are plotted in Figs. 5, 6 and 7.

Table III.—Test Results of Concrete Designed for 550 Lb. per Sq In. Modulus of Rupture at 7 Days.

No.	W/C	Flow	Bags Cement per Cu. Yd.	Proportions Dry, Loose Volume			Modulus of Rupture lb. per sq. in.		Crushing Strength lb. per sq. in.	
				Cement	Sand	C.A.	7-day	28-day	7-day	28-day
2	.87	165	5.45	1	2.60	3.54	571	689	2850	4130
3	.69	160	6.69	1	1.74	2.94	555	668	3820	5660
5	.85	166	5.83	1	2.46	3.41	514	672	2430	4270
6	.72	169	6.57	1	1.78	2.84	553	619	3240	4710
7	.85	164	5.60	1	2.41	3.46	505	707	2890	4440
8	.85	164	5.24	1	2.48	3.57	523	702	2630	4270
9	.85	164	5.50	1	2.18	3.75	559	644	2980	3920
12	.77	165	6.49	1	2.11	2.64	557	659	2940	4670
13	.84	167	5.81	1	2.43	3.19	591	744	3130	4400
17	.73	174	6.46	1	2.00	2.74	590	703	3100	4830
23	.84	156	5.63	1	2.24	3.57	515	727	2540	4360
24	.75	165	5.82	1	2.04	3.51	544	725	2990	4680
27	.87	159	5.44	1	2.38	3.74	530	741	2720	4060
28	.72	167	6.71	1	1.76	2.64	544	673	3390	4990
29	.80	164	5.55	1	2.32	3.38	517	688	2560	4260
31	.60	174	8.60	1	1.20	2.02	516	643	3980	4970
32	.82	169	5.93	1	2.22	3.19	535	733	2830	4540
35	.87	162	5.17	1	2.50	4.10	509	684	2300	3840

The strength value which was aimed at was 550 lbs. per sq. in at 7 days and the plotted points will show how closely the actual test results approximate the desired result. The average of the 7-day results on all of the materials was 540 lbs. per sq. in. as compared with the desired design value of 550 lbs. per sq. in. The individual test results are rather close to the value desired. Considering the small number of specimens made in our preliminary work to establish the necessary water-cement ratio, the accuracy of this method seems all that could be desired. It can be definitely stated that with this laboratory method it is possible to determine the proportions of concrete needed to produce a desired modulus of rupture with a comparatively small percentage of error.

A brief review of the method of procedure seems desirable at this time. The various steps in the operation are:

1. Establish the basic water-cement ratio—modulus of rupture curve for typical crushed stones and gravels expected to be used. (Fig. 1).
2. With the fine and coarse aggregates proposed for use, make up a trial batch of concrete with an as-

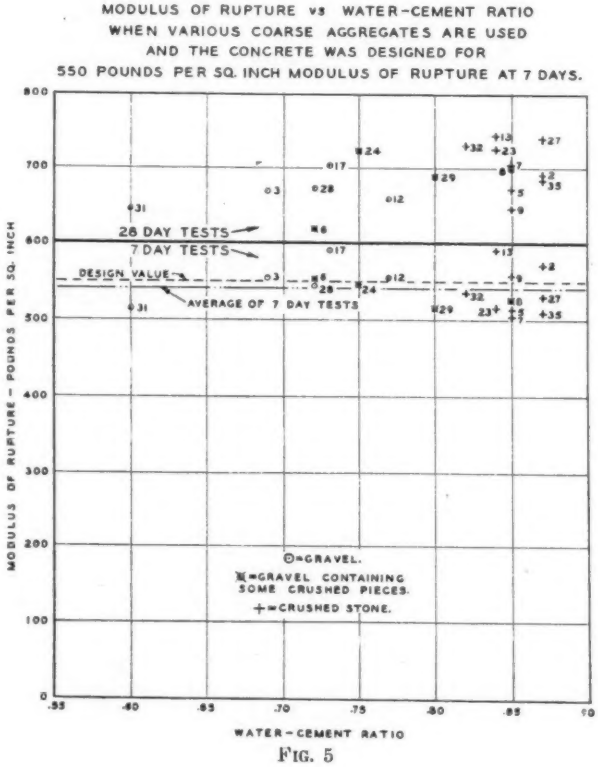
MODULUS OF RUPTURE vs WATER-CEMENT RATIO
WHEN VARIOUS COARSE AGGREGATES ARE USED
AND THE CONCRETE WAS DESIGNED FOR
550 POUNDS PER SQ. INCH MODULUS OF RUPTURE AT 7 DAYS.
28 DAY TESTS
7 DAY TESTS
DESIGN VALUE
AVERAGE OF 7 DAY TESTS
⊙=GRAVEL.
⊠=GRAVEL CONTAINING SOME CRUSHED PIECES.
+=CRUSHED STONE.
MODULUS OF RUPTURE - POUNDS PER SQ. INCH
WATER-CEMENT RATIO

FIG. 5

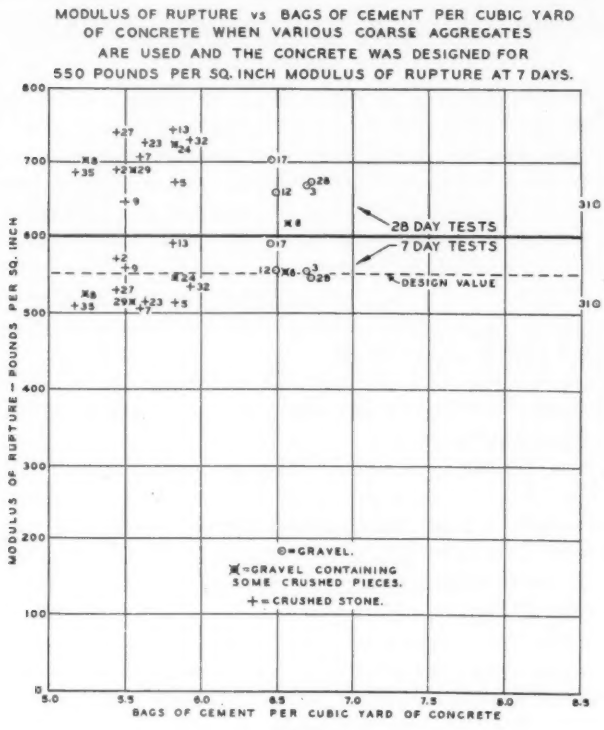
MODULUS OF RUPTURE vs BAGS OF CEMENT PER CUBIC YARD OF CONCRETE WHEN VARIOUS COARSE AGGREGATES ARE USED AND THE CONCRETE WAS DESIGNED FOR 550 POUNDS PER SQ. INCH MODULUS OF RUPTURE AT 7 DAYS.
28 DAY TESTS
7 DAY TESTS
DESIGN VALUE
310
310
⊙=GRAVEL.
✕=GRAVEL CONTAINING SOME CRUSHED PIECES.
+=CRUSHED STONE.
MODULUS OF RUPTURE - POUNDS PER SQ. INCH
BAGS OF CEMENT PER CUBIC YARD OF CONCRETE

FIG. 6

sumed water-cement ratio using a ratio of fine to coarse determined from Fig. 2.

3. At the desired test period, obtain the modulus of rupture of the concrete.
4. Plot this result and through it draw a water-cement ratio—modulus of rupture curve parallel to the basic curve. (Figs. 3 and 4).
5. Where this curve, for the given materials, crosses a horizontal line representing the desired strength, read off the necessary water-cement ratio.
6. Make up a new trial batch using this water-cement ratio and determine the proportions by well-known laboratory methods.

The strength results obtained from this concrete should be very close to the desired modulus of rupture.

Figs. 5, 6 and 7 are of interest in several ways. In the first place, it is to be noted that the crushed stone concretes have as high cross-breaking strengths as the gravel concretes notwithstanding the fact that they almost universally have a much higher water-cement ratio. It is also plain in Fig. 6 that the stone concretes have attained as high 7-day beam strength as the gravel concretes, or practically so, with a smaller cement content. There are some exceptions to this rule, particularly where the gravel contains crushed and calcareous fragments.

There is still another fact of interest, namely, that at 28 days the crushed fragment concretes seem to have gained more strength than the concretes containing rounded fragments. Perhaps this is due either to a somewhat better bond or somewhat greater strength of the fragments.

These statements are not intended to convey the impression that in all cases crushed stone may have a higher water-cement ratio and lower cement factor than gravel concrete for that may not be the universal rule. Nevertheless there seems to be a general tendency in that direction and probably that will be the more usual condition with exceptions here and there.

The outstanding fact is, however, that the method here presented permits of the design of concrete which will have approximately the same cross bending re-

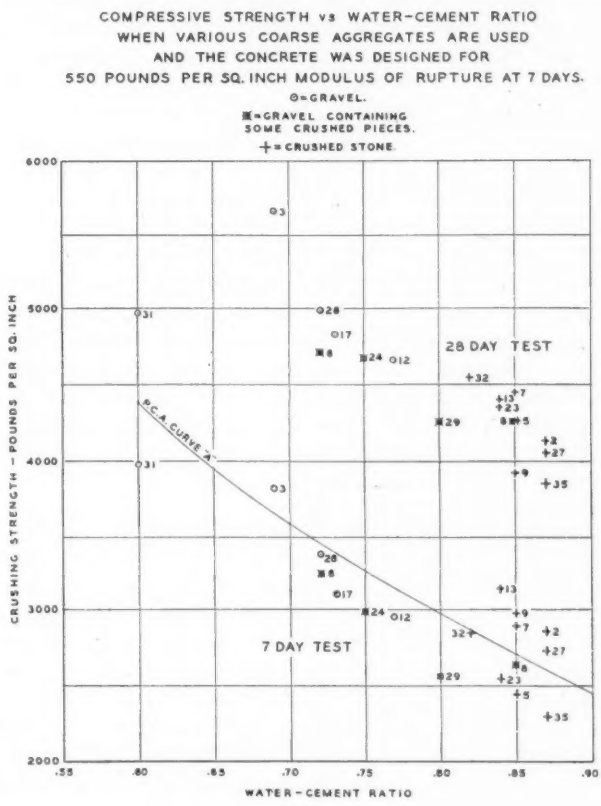
COMPRESSIVE STRENGTH vs WATER-CEMENT RATIO WHEN VARIOUS COARSE AGGREGATES ARE USED AND THE CONCRETE WAS DESIGNED FOR 550 POUNDS PER SQ. INCH MODULUS OF RUPTURE AT 7 DAYS.
⊙=GRAVEL.
✕=GRAVEL CONTAINING SOME CRUSHED PIECES.
+=CRUSHED STONE.
28 DAY TEST
7 DAY TEST
R.C.A. CURVE A
CRUSHING STRENGTH - POUNDS PER SQ. INCH
WATER-CEMENT RATIO

FIG. 7

sistance. This is a most important fact in connection with concrete pavement design. Incidentally, it is

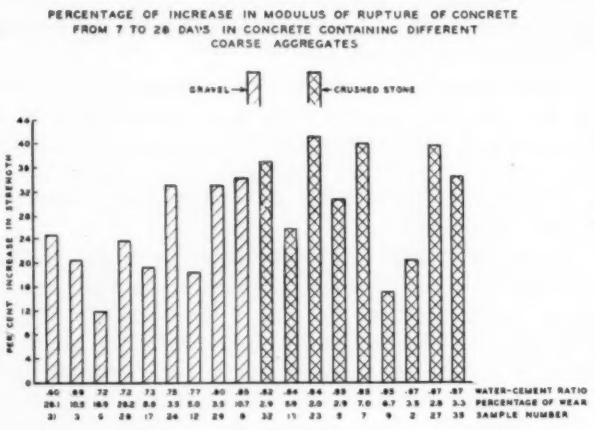
PERCENTAGE OF INCREASE IN MODULUS OF RUPTURE OF CONCRETE FROM 7 TO 28 DAYS IN CONCRETE CONTAINING DIFFERENT COARSE AGGREGATES
GRAVEL
CRUSHED STONE
PER CENT INCREASE IN STRENGTH
WATER-CEMENT RATIO
PERCENTAGE OF WEAR
SAMPLE NUMBER

FIG. 8

pointed out that the crushed stone concretes, having a higher water-cement ratio and a lower cement factor also have somewhat lower compressive strengths than the gravel concretes when their values for modulus of rupture are about alike. For concrete pavement design this is unimportant for pavements do not fail by crushing; they fail by lack of beam strength.

In Fig. 8 is shown the percentage of increase in modulus of rupture of the various concretes at 28 days as compared with 7 days. In some cases the crushed stone has gained strength in greater proportions than the gravel concrete and in other cases the reverse is true, but it seems as if the angular coarse aggregates in this series show a greater tendency to gain beam strength than the rounded fragments. Perhaps another selection of gravels and stones would show a different result but, none the less, it is felt that the materials used cover about the range of characteristics of gravels and stones to be found in commercial use.

Illinois Highway Work Soon to Start

SHORTLY, the State of Illinois will begin its 1930 road construction program of 750 miles of new pavement, involving the expenditure of $26,000,000 to $30,000,000, according to a statement issued by the director of public works and buildings, H. H. Cleaveland, and the chief highway engineer, Frank T. Sheets.

The first road letting of the 1930 season will be held on April 11, they stated, at which time the Department will receive bids for the paving of 140 miles of road, for 26 miles of heavy grading and for the construction of numerous large bridges. The estimated cost of this first series of projects is approximately $5,000,000, it was stated.

South Carolina to Expend $16,000,000 for Highways

CONTRACTS for highway construction to cost approximately $16,000,000 are ready to be let as a result of what was termed the "virtual dismissal" by the Supreme Court of the United States of an appeal involving South Carolina's $65,000,000 bond issue, according to an announcement by the chief highway commissioner, Ben M. Sawyer.

Road and bridge work representing 562 miles of hard-surface and 95 miles of earth-type roads, together with the necessary bridges, will be done simultaneously in the State's 14 judicial districts, Mr. Sawyer stated. Twelve full survey parties now are in the field, he said.

At the same time Mr. Sawyer announced a list of road and bridge work ready to be let as authorized and directed by the highway commission. The proposed work is to be started almost immediately, he said, and involves practically every city, town and village in the State.

"The State highway commission has not adopted a construction program," Mr. Sawyer stated, "and therefore it is not known the particular roads that will be advertised for the first or early lettings. The construction of connecting links in the hard surface system and the construction of important roads in counties where little or no paving has been done will be given priority in the making of the State-wide construction program.

"It will be the purpose of the State highway commission first to provide hard surface connections between the centers of population and necessary trunk lines for through travel. The system will be built simultaneously in the 14 judicial circuits and the work will be let as orderly as can be done economically.

"The roads which are now ready to let represent 562 miles of hard surface and 95 miles of earth type, together with necessary bridges. The total estimated cost of constructing the roads and bridges now ready to be let to contract is $16,000,000. We now have 12 full survey parties in the field, and the drafting room is operating at capacity in the preparation of plans.

"The completion of these roads will provide a continuous roadbed of dependable type that will connect practically all of the cities and community centers of the State. Greenville, Spartanburg, Columbia, Charleston, Anderson, Florence and the other cities of the State will be the chief financial beneficiaries of these motor vehicle trunk lines."

Trade Association Activities in the Development of Ethical Standards[1]

By Abram F. Myers
of the District of Columbia Bar

I.

DESPITE the rising tide of denunciation of the competitive system of industry, it is probable that a majority of our citizens still believe that competition is the life of trade. Whilst admitting (or ignoring) the wastes of competitive distribution, they maintain that these are more than offset by the stimulated efficiency in production. They also believe that competition stands between them and extortion. And they are fearful that the abandonment of the competitive principle would lead to some form of socialism.

So deeply imbedded in the policy and laws of the United States is the competitive principle, that there is little likelihood it will be seriously abridged for years to come. Any attempt at this time to obtain relief from existing antitrust laws probably would result in even more stringent enactments. Feeling against the trusts runs higher in times of industrial recession, such as we are now undergoing, than when prosperity reigns. These are the conclusions to be noted in recent studies of the subject. Industry has resolved to make the best of the latitude the law allows rather than throw so delicate a subject into the welter of politics.

It is a mistake to assume that the antitrust laws, however annoying, have put a straitjacket on business. Combinations which would have appalled the country a few decades ago now are contrived without fear of law violation or social upheaval. Possibly there is a touch of fatalism in this. The main reason, however, is that the public, whilst clinging to certain fundamentals, has become more tolerant as conditions have changed. There is abundant evidence that the managers of great enterprises have a keener realization of their obligations to the public than formerly. And the people, having learned through the Liberty Loan campaigns that paper can represent wealth, are yearly increasing their holdings of corporate securities.

The main difference, however, is that the people have observed and taken into account the enlarging field of competition. They have learned the almost limitless possibilities of substitution. They have learned that whatever may be the potentialities of a combination over the commodity it has engrossed, excesses will be checked by other industries eager to enter its field. This new competition is daily proving itself more rigorous than the old. A few years ago we could not have imagined a serious competitive warfare between tobacco and candy, but we have lately been the amused onlookers in such a struggle. Less spectacular but more substantial are the battles waged between steel and concrete, steel and wood, coal and oil, glass and metal (containers), railroads and buses, and so on.

This enlarged and intensified competition has given rise to new problems not within the contemplation of the framers of the antitrust laws. To compete successfully in this broader field an industry must first put its house in order. It can not hope to cope with outside competition if internal competition is out of control. In this situation rugged individualism gives way to industrial solidarity. The excesses of internal competition must be curbed if the industry is to be saved. Such excesses tend not merely to exhaust the industry but to diminish the good will of its products. Price wars lead to degradation of quality and this in turn invites substitution. The processing of modern industry is not so much for aggression as in self-defense.

This battle of the substitutes is mainly responsible for the trend towards ethics in business. In present day usage "ethics" is a term of some elasticity. The foundation stone of modern industrial cooperation is the ethical code. These codes are designed to regulate the relations of the members of an industry with each other, and the relations of the industry and the public. Adherence to the code is a condition of membership in most industry associations. The justification for these codes, so far as they tend to elevate business practices and protect the public, is manifest. When they touch on the important subject of prices they become the objects of suspicion. They have great capacity for good, and evil. They present a new problem in regulation with which existing agencies are not equipped to deal.

[1] Presented before the Bureau of Personnel Administration, New York, January 16, 1930.

II.

Efforts to achieve price stabilization have taken a new form. Price agreements are no longer resorted to because their illegality is too well established and their futility has too often been demonstrated. Whilst the antitrust laws have been successfully invoked against price agreements, the most effective regulator has been human nature, a polite name of innate cupidity. Experience teaches that in every industry there are some who will take advantage of the situation created by a price agreement to undersell their "ethical" competitors and thus increase their volume. Therefore, industries no longer seek stabilization through price agreements, but by the more legal and effective means of outlawing price discrimination.

Reduced to their essence, the Sherman Law is directed against "restraint of trade"; the Federal Trade Commission Act condemns "unfair methods of competition"; and Section 2 of the Clayton Act makes it unlawful "to discriminate in price between different purchasers of commodites." Together these acts comprise the antitrust laws of the United States; they are *in pari materia*. There is not much difficulty in reconciling the first two provisions cited. All of the great combinations condemned under the Sherman Law have been characterized by unfair and oppressive practices. Unfair methods of competition, long persisted in, inevitably give rise to restraint of trade and monopoly. It is the last mentioned provision (also the latest in point of time), which has a purpose consistent with the others, but which authorizes practices somewhat at odds with the other two.

The underlying thought of Section 2 of the Clayton Act is that price discrimination as between persons and communities is an effective weapon in the building up of monopolies. There was much in the practices of the trusts that had been condemned just prior to the enactment of the Clayton Act that supported this view. Those great organizations frequently sold at low prices, sometimes at a loss, to certain customers or in certain communities, for the purpose of driving out competition, whilst recouping their losses elsewhere by charging higher prices. The policy which the section sanctions is the "one price" policy which business leaders have long sought as a means of dulling the sharp edge of competition. It means that a manufacturer or dealer in interstate commerce, having adopted a schedule of prices for his products, must adhere to such schedule as to all customers until it is changed, when it shall be changed as to all customers. Whilst the stability thus achieved has not the rigidity of a price agreement, price wars are effectively outlawed without destroying individual initiative.

It may be argued that Section 2 was not intended to have any such effect; that the exceptions to the section are the true index to its scope. This view can be justified only by disregarding accepted canons of construction. The section establishes a policy of opposition to price discrimination; the exceptions are not mandatory, but are to relieve the individual in certain circumstances from the policy so declared. Following the decision of the Supreme Court in the American Can Case, 278 U. S. 246, upholding the section, trade associations have eagerly fastened their affections on this statute in an effort to find relief from the earlier enactments. Thus we find in a majority of recent codes of ethics a declaration against price discrimination in the very language of Section 2; a voluntary re-enactment of the statute, as it were.

So long as there is no collusion between the members of an industry in fixing a common price, and each acts with respect to prices individually, it would seem that the public has received all the benefits of competition which the law contemplates it should have. Any incidental stabilization resulting from the observance of a one price policy not only is justified by the statute but is a healthy thing in itself. In any case the result is achieved by observance of the letter of the law; it can not be attributed to subtlety in the processing of industry, but to lack of comprehension of the part of Congress as to the scope of the language employed. I doubt whether Congress, if the subject were reconsidered in a scientific way, would alter the policy of the later act; rather, I believe that the legislature, in this instance, would be forced to conclude that the (possibly) unintended effect of the statute is in the public interest and that they builded better than they knew.

Codes of ethics rarely contain provisions unlawful in themselves. Rather they are apt to be liberally sprinkled with what one member of the Supreme Court has termed "pious protestations." I know of no trade association that has been convicted on the recitals of its organization papers alone. The test is not what is said, but what is done. A prosecuting officer can not discern from a mere paper plan what activities may be engaged in thereunder. Perhaps it is for that reason that the Department of Justice has reversed its earlier policy of passing on codes of ethics submitted by trade associations. The proper under-

standing of such a plan requires a thorough grasp of the details of the industry affected, and that the prosecuting officer does not have. A lawyer, moreover, is not the best qualified person to decide such questions; they lie rather in the field of the trained economist or experienced business man. There is no reason, however, why an association can not be successfully prosecuted if its operations give rise to the restraints which are the indicia of law violation. The complaint that industry has been so subtly processed as to defeat the law is a mere shield for a timorous and unimaginative attitude on the part of enforcement officers.

III.

The trade practice conference work of the Federal Trade Commission deserves a high place in the activities of the Government designed to aid the lawful business of the country. From a narrow procedure designed to permit of the wholesale renovation of industries pestered by practices that were clearly unlawful, the work has been expanded to include the reception of resolutions against practices not unlawful per se but which are uneconomic and undesirable. The advantage from the standpoint of industry of this enlargement of the scope of the procedure rests in the fact that the reception of resolutions of the latter class gives assurance that they are not objectionable from the standpoint of the law. Also the calling of such a conference by a Federal agency provides a rallying point for unorganized industries, and strong and well-conducted trade associations have frequently resulted from such meetings.

The procedure, however, has been marred by an inconsistent and vacillating policy on the part of the Commission. The Commission undertook in the beginning to distinguish between resolutions of the kinds above mentioned by separating them into two groups. It has too often happened that a resolution placed in one group for a particular industry is placed in a different group for another industry. This apparently has resulted from a failure to act with due regard to what had been done in previous cases. Again the Commission, after having announced that the secret violation of a group 2 resolution would be treated as a violation of the Federal Trade Act, reversed the policy without its having been tested in the courts, thus placing an undue emphasis on the right of the individual to secretly violate that which has been openly professed. The National Industrial Conference Board after a careful review of this reversal of policy has concluded that it was a "mistake"; certainly it has greatly weakened a procedure which affords a wide field of usefulness to a body never strongly entrenched in the affections of the people.

Time will not permit of a lengthy review of these trade practice conferences, interesting though it would be. By this procedure unfair practices have been outlawed by the wholesale and entire industries have been cleaned up at one sitting. False and misleading advertising, shortages of weights and measures, unfair disparagement of competitors and their products, enticement of employees and unlawful interference with contracts, departures from standards of grade and quality and established customs of the industry, price discrimination and secret rebates—these and many equally bad practices have been outlawed by the conferences. The benefits to the public from the elimination of such practices are inestimable. Moreover, they have served to teach the members of these industries the rudiments of cooperation, a lesson sadly needed by most of them. For progress in such matters is dependent on group action. It rarely happens that the standards of an industry are raised by one, or a few, acting singly. One man's ethics constitute another man's opportunity. Practical men demand assurances from their competitors before venturing into the unaccustomed realm of "ethics."

Whether the encouragement of the so-called group 2 resolutions is the proper function of the Government may well be questioned by the strict constructionists. From the standpoint of results achieved, I do not think the question is of much importance. The Trade Commission by its friendly attitude may have hastened the control of industry by what has been aptly termed the "huddle system," but no more than that. The movement had gathered considerable force before the Commission volunteered its aid, and would have run its course without encouragement from official sources. It might, of course, have been frustrated had the prosecuting authorities taken a fine sight on the law in the consideration of some of the early plans. A determined gesture by the Department of Justice frequently has halted predatory tendencies without a final test of the legal principles involved. But that sort of trust-busting is no longer the fashion and has been resorted to only a few times since the Taft Administration.

If the policy of the Commission has exerted any influence in the matter of industry codes dealing with

(*Continued on page* 20)

Stone Sand—Its Successful Use and Characteristics[1]

BY M. L. JACOBS
Bethlehem Mines Corporation, Bethlehem, Pa.

NOT many years ago it was not an uncommon sight in parts of the country where sand was scarce and limestone of good quality plentiful, to see concrete being mixed using as fine aggregate varying amounts of stone dust mixed with sand. The amount of dust used depended usually on these factors: The availability of good concreting sand, the quality of the dust and the degree of acquiescence obtainable from the engineer or architect. I realize fully that many an engineer and architect would throw up his hands in holy horror at the idea but I know where there are a great many building foundations and heavy machinery foundations whose concrete has been mixed with a fine aggregate drawn directly from our dust bins. I am not recommending the practice, I am citing the fact. Of course there were failures in concrete mixed with dust, not, however, may I state, with dust that we supplied. The failures came from using a dust that carried so heavy a percentage of extremely fine material and dirt that concrete simply could not be made from it.

Some eight years ago our company built its first washing plant at our Bethlehem Quarry. The products of our Bethlehem Quarry are blast furnace flux, washed commercial sizes of stone and washed limestone sand. We found no difficulty whatever in disposing of the ordinary commercial sizes of stone from plus ⅝ inches up, but the sizes minus ⅝ inches, i. e., our number one stone, ¼" to ⅝", and our sand, 0" to ¼", began to accumulate. There has been a fair demand for the number one stone but not enough to meet the production.

During our first two years of operation we met the strongest kind of opposition to the use of our sand for any purpose whatever. A great deal of this prejudice we found to be due to the fact that it did not look like sand. We were quite willing to agree that it did not look like ordinary bank or river sand and the question finally arose as to what is sand. The standard dictionary describes it as a grain or particle of rock material large enough to be easily visible to the naked eye but not so large as to be regarded as a stone or pebble. Clearly this definition embraced our product and we were justified in calling our product sand and not screenings as had been the common habit wherever the sand was seen. It took no small amount of persuasion to convince the engineers of our own company that we had a suitable fine aggregate for concrete. This difficulty with our own family made us realize that there is only one way to convince anyone and that is with irrefutable facts. Immediately we called in the engineers of the Testing Laboratory at Lehigh University and had them begin a series of tests. We had been confident that our product was as good as any commercial sand in our market for concrete work, but we had not assumed that it was better. The results of our laboratory tests were so much better than we had anticipated that we were actually surprised.

Using Standard Ottawa sand, Succasunna sand and Bethlehem Quarry sand in 1-3 and 1-2 mixtures we had the following results in seven days:

TENSILE STRENGTH

Ottawa		*Succasunna*		*Bethlehem Quarry*	
1-3	1-2	1-3	1-2	1-3	1-2
194	268	184	212	230	298
		In 28 Days			
305	450	250	363	573	584

COMPRESSIVE STRENGTH

		In 7 Days			
875	1510	710	1450	1570	2200
		In 28 Days			
1620	4155	1670	2790	4120	4965

These tests were made on samples taken by Mr. R. L. Fox, engineer of the City of Bethlehem. When Mr. Fox saw these results he concluded that he had found a material better than any sand previously available in this market. Several possibilities were presented. It was possible to use concrete made from this sand in seven days with practically the same strength obtainable with other sand in four weeks. It was possible to use a weaker cement mix and have

[1] Presented at the Thirteenth Annual Convention, National Crushed Stone Association, Cincinnati, Ohio, January 21, 1930.

the same ultimate strength in the concrete or it was possible so to design that thinner sections would do the same work. Subsequent tests by other laboratories have verified the above results. It will be of interest to note a screen comparison between Succasunna sand and Bethlehem Quarry sand.

SIEVE ANALYSIS OF AGGREGATES

Per Cent of Sample Coarser Than a Given Sieve

Sieve Size	Size of Square openings—ins.	Succasunna Sand No. 1	Succasunna Sand No. 2	Limestone Screenings No. 1	Limestone Screenings No. 2
100 mesh	.0058	96.3	95.8	95.7	95.8
48 mesh	.0116	76.4	80.7	88.1	87.1
28 mesh	.0232	37.6	38.1	77.0	75.3
14 mesh	.0460	13.1	13.7	62.6	61.1
8 mesh	.0930	.2	.2	35.7	34.6
4 mesh	.1850	0	0	1.4	1.3
3/8 mesh	.3710	0	0	0	0
Fineness Modulus		2.23	2.28	3.60	3.55

	Succasunna	Limestone Screenings
Per cent retained on 50 mesh sieve..	100	90
Per cent passing ¼" sieve	78	99

You will note that the fineness modulus of the Succasunna sand is 2.25 and that of Bethlehem sand is 3.57. The screen analysis tells the tale. The grading from fine to coarse in the Bethlehem sand is such that the greater strength is developed.

Armed with these facts we began to approach engineers and architects with real confidence in our product. The City of Bethlehem laid a new concrete pavement about three miles long and used our sand and stone. The combination of the washed stone and washed limestone sand gave a road that is better than that laid with any other aggregate in our locality. We at last had a sample to show. The sample was convincing and is more convincing today than it was five years ago.

The following summer one of our customers wrote us a letter which I am going to read to you.

Gentlemen:

I wish to call your attention to the enclosed sketch.

This sketch shows the condition of the 15th Avenue, Bethlehem concrete road after high pressure water main broke and washed out the ground under concrete road which we constructed last year. We had no idea the ground was washed out like this and had a 33-ton Erie steam shovel go over this section several times while working near there. After we dug up the concrete I was amazed to think this slab carried the shovel with such a span, so I measured the hole and had this sketch prepared.

This road was laid with your stone and stone sand, with the Pennsylvania State Highway specification of 1:2:3 mix and wire mesh.

I am convinced that concrete laid with your stone sand has considerable more strength than concrete laid with the regular sand, and am sending this sketch to you because I thought you might be interested in knowing this.

Yours very truly,

F. H. CLEMENT & CO.
(Signed) D. H. BRILLHART,
President.

Next followed a motor ramp garage in the neighboring city of Allentown. Sand for this job was sold to an engineer. The foundations for the twenty-three story Pennsylvania Power & Light Company's building in Allentown were poured with our sand specified in the concrete although we did not sell the stone. The ball had started rolling. We began one year with nearly forty thousand tons of sand in stock. We ended that year scraping the bottoms of the piles for sand to supply the demand. At no time in the past three years has our Bethlehem plant been able to meet the demand for this product.

Two years ago our Hanover washing plant went into operation and this year washing plants at our Steelton and Naginey quarries have begun production. The first thing we have done at each plant is to submit samples for analysis and tests to recognized engineering laboratories. The results have shown our sand to be uniformly better than that obtainable in any of our markets and we rest our hopes on the ability of engineers and architects to understand that point.

There is one feature of this product, however, that must be recognized. Due to the coarse particles this sand does not make a satisfactory mortar or plaster sand, but is suitable only for concrete. The finer sizes, of course, can be made but there is a resultant waste product which is commercially useless so far as we have been able to discover. However, the requirement for a more satisfactory concrete sand should absorb all the washed limestone sand that is made.

We have found in our experiments with this sand in the laboratory and in the field that the ordinarily accepted mixtures of 1-2-4, 1-2½-5 and 1-3-6 can be modified with benefit to the cost of concrete by increasing the amount of fine aggregate used in the mixture and decreasing the coarse aggregate. We find that some of our customers make the changes in proportions and secure a stronger concrete with a more satis-

(*Continued on page* 18)

The Importance of Proper Specifications for Crushed Stone[1]

By L. C. Bonnell
F. R. Upton, Inc., Newark, N. J.

SINCE the first intelligent efforts of the human race, and in every field of man's activity, there has been a more or less constant striving after improvement, not only in the character of these activities but also in methods followed and in materials used. In order to maintain such improvement in methods and materials, it has long been the custom to record details, and when further enterprises were contemplated, to make use of the knowledge acquired by experience, to the end that the results might be of the best. This practice has resulted in the use of specifications governing the quality and properties of materials to be used, and controlling the conditions surrounding the combination of raw materials into finished products.

It would appear that broken stone is one of the latest items appearing on our lists of raw materials, and as such, requires the application of experience and research so that its use may be so safeguarded that it shall not suffer through lack of proper specifications.

These specifications are of importance to the engineer, that he may know the various properties on which to base his calculations, and to the producer, that he may know the best application of his product and how most effectually to meet inevitable competition. A century or more ago John Loudon MacAdam showed that a much better and more durable road could be constructed if the practice of using material consisting of a mixture of large and small particles were abandoned and the sizes separated and laid in layers; the large pieces on the bottom and small ones above. This principle has endured, regardless of the passage of years and unchanged by the adoption of a variety of binders for the purpose of adding stability to the pavement.

With the advent of moderate cost cement, and the resulting use of concrete, a new era was introduced to the world, opening new fields to the engineer and new markets to the stone producer. At first it was but natural that the various sizes of broken stone as already manufactured for macadam roads should be used for concrete; larger sizes for heavy work, smaller sizes for reduced cross-sections, but this tendency was, unfortunately, a factor in the comparative weakness of much early concrete, and at the present time many engineers fail to appreciate the influence exerted by improperly graded coarse aggregate, or by the use of so-called straight sizes rather than graded stone.

Illustrating this point let us note the necessary proportions of cement, fine and coarse aggregate as applied to the product of a specific quarry. We find at this plant, stone classified as 1½", ¾" and ½", or dustless screenings, as specified in the New Jersey State Highway Specifications for 1926. Permissible variations in size are indicated as follows:

Commercial Sizes	Total Per Cent Passing Laboratory Screens (Round openings)					Sieve Nos.	
	2¼"	1¼"	⅝"	½"	¼"	10	30
1½" Stone	100	0-15	0-5				
¾" Stone		100	0-25	0-10	0-5		
½" or Dustless Screenings			95-100	25-75	0-30	0-15	0-5

Using the loose volume measurement as applied in common practice, voids in the 1½" stone will average approximately 49½ per cent, those in the ¾", 53 per cent, and in the ½", 53½ per cent. Assuming a ratio of cement to coarse aggregate of 1 to 4 and providing sufficient sand for proper filling of voids and good finishing, we have a cement-sand ratio as applied to the 1½" stone of 1:2.2. Applying the same formula to the ¾", we find the cement-sand ratio 1:2.35 and if ½" stone is used, 1:2.38.

If, however, we combine these three sizes in proper proportions we can secure a graded concrete stone showing 46 per cent voids and resulting in a cement-sand ratio of 1:2.04, a reduction of 7 per cent in the quantity of sand and consequently a stronger mortar, while an improper combination of these sizes may result in voids as high as those found in the straight ¾".

The proper grading of stone for concrete and the resultant reduction in cement-sand ratio is not only the cause of increased strength but also much better workability, which is perhaps one of the greatest aids to the contractor, especially on concrete surface pavements.

When the stone producer is faced with gravel competition and more particularly gravel containing little

[1] Presented at the Thirteenth Annual Convention, National Crushed Stone Association, Cincinnati, Ohio, January 21, 1930.

or no crushed material, he may very readily lose business on account of poor workability unless he is ready to furnish properly graded material, but if he has made a determined effort to find the correct grading for his own product and perhaps shown the engineer in charge of specifications what the requirements and limitations as to sizing should be, he will be rewarded by workability equal, and in many cases superior, to that of gravel concrete.

Two years ago the writer, after long effort, prevailed on the New Jersey State Highway Department to try out a low void mixture on one of their contracts, and it was approved after two batches had been run through the mixer, and the State Specifications for concrete stone for 1928 were written with this grading as the basis. Previous to this time we had been unable to induce the Highway Department to include, in their requirements, enough fine stone, (½" and under), to produce low voids or give workable concrete. The grading used in this particular instance was: Passing 2¼" hole 100%; 1¼", 43%; ⅝", 23%; ½", 13%; ¼", 5%.

The New Jersey State Highway Specifications for 1926-1927 were also based on a fixed cement-fine aggregate ratio with the result that contractors, under the requirements then in force, were required to use as much as sixty-four one-hundredths of a bag more cement per cubic yard in crushed stone concrete than in some of the concrete in which small, soft gravel was used. Assuming the cost of cement to be 60 cents per bag at the mixer, this handicap amounted to 8½ cents per square yard of eight-inch pavement, with the gravel concrete showing much better workability.

The fallacy of such specifications is apparent if one will refer to the Bound Brook Tests as shown on page 49 of Bulletin No. 5, issued by the National Crushed Stone Association, where it is shown that concrete made with the gravel which we have just mentioned would probably require 7.8 bags of cement per cubic yard of concrete to give transverse strength equal to that of concrete using Trap Rock or Dolomite and containing 6 bags of cement per cubic yard, an increase in cement with this gravel of 30 per cent.

These facts are also borne out in a general way, by the report of tests made by the Bureau of Public Roads in Vol. 10, No. 4, of "Public Roads," June, 1929. We would, however, call attention to the fact that the softest gravel included in the Bureau of Public Roads tests showed a per cent of wear of 15, and contained from 67 per cent to 92 per cent of crushed material, while the ¾" gravel used in the Bound Brook tests shows from 25-30 per cent of wear and contains no crushed material.

While it will appear to some producers that the use of so large a percentage of small material in concrete will mean increased cost of production, we are of the opinion that saving in cement and better workability of concrete will compensate the purchaser for any necessary increase in cost.

While suitable stone specifications and their observance are essential to the stone producer as well as the consumer, it is also of the greatest importance to both that the equipment used on the job should be so designed that there is the least possible change in the character of the aggregates. Unfortunately, it has been clearly shown that most, if not all, of the concrete mixers in use at the present time tend to destroy any ideal grading through segregation during mixing, and we feel that much of the lack of uniformity in concrete is traceable to this cause. Analyses of samples taken from different parts of the same batch will show wide variation in grading. We feel that manufacturers of concrete mixers can render a real service by an earnest attempt to develop a machine which will deliver concrete with the aggregate at least as well mixed as when it enters.

In conclusion let me urge the individual members of this Association to use every effort to accomplish the standardization of sizes, and of specifications affecting the use of crushed stone so that engineers, producers and consumers may talk one language. We are all only too familiar with the troubles and expenses due to differences in specifications not only in adjoining states but as used by different engineers working in the same territory.

Colorado Highway Funds Approved

COLORADO'S highway department budget calling for the expenditure of $6,202,202 during 1930 for construction, maintenance and administration has been signed by Governor William H. Adams. In addition to this sum, there is $3,593,416 left from 1929 to complete that year's budget, most of which will be expended for construction, according to the Department.

The estimated revenue for 1930, the Department has announced, consists of $4,086,000 from 70 per cent of the 4-cent gasoline tax, $1,796,202 Federal aid funds, $60,000 motor bus tax, $60,000 internal improvement fund, $25,000 county participation, and $175,000 from the 1929 balance.

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James H. Cooke

TO his many friends and associates throughout the crushed stone industry, the sudden death on March 20, of James H. Cooke, president of the Hartford Sand and Stone Company of Hartford, Connecticut, and also of the Lynn Sand and Stone Company of Swampscott, Massachusetts, will be a distinct shock. Although a comparatively new member of the National Crushed Stone Association, having joined in August, 1927, he was ever sympathetic to and most generously supported its activities. His passing will leave a vacancy difficult to replace. Our deepest sympathy is extended to his many friends and business associates in their bereavement.

Mr. Cooke, whose life had been exceptionally free from sickness, was apparently in the best of health when the end came without warning when he was taking his morning shower at his recently constructed residence on Ocean View Road at Swampscott, Massachusetts.

Mr. Cooke was a pioneer in the crushed stone industry in New England. Originally in the ice business at Plainville, Connecticut, he first became interested in the production of crushed stone in 1893 when he opened a trap rock quarry and crushing plant in that town. This he operated until 1899 when he sold out to the White Oak Stone Company and established a new quarry and crushing plant at Rocky Hill, Connecticut. This operation was merged with the Connecticut Quarries Company in 1902 and Mr. Cooke became general manager of that company, serving in that capacity until 1918 when he gave up that position to organize the Hartford Sand and Stone Company, with quarries and crushing plant at Farmington, Connecticut, and a sand plant at East Hartford, Connecticut. A few years later he further enlarged his interests by opening a crushed stone plant at Swampscott, Massachusetts, under the name of the Lynn Sand and Stone Company.

He continued as a director of the Connecticut Quarries Company until that organization retired from business in 1925.

Mr. Cooke is survived by his widow, two daughters, and son, Theodore, who was associated with him in business at the time of his death.

Sign the Trade Practice Rules

IMMEDIATELY following the Cincinnati Convention held last January, the crushed stone industry held, under the jurisdiction of the Federal Trade Commission, a Trade Practice Conference. The results of this conference should be thoroughly familiar to the entire industry. The rules as approved were published in full in the January issue of the *Journal*.

To those who may have perhaps lost sight of the steps leading to this action of the industry, a brief review will no doubt be helpful. The urge to remove present uneconomic and unfair trade practices came from the industry itself and was first manifested at the time of the Cleveland Convention (1929), when it was recommended by the retiring president, Mr. Graves, that a committee be appointed to develop a code of trade practice applicable to the crushed stone industry, such code to be presented to the Board of Directors at its mid-summer meeting. Directly following the Cleveland Convention a committee on Trade Practice was appointed. This committee in collabora-

tion with representatives of the Federal Trade Commission and the United States Chamber of Commerce, after a most careful and painstaking study of the then existing codes of other industries, drafted a set of resolutions which were presented to the Board at its meeting last summer. The Board approved the resolutions and decided to request the Federal Trade Commission to call a trade practice conference for the industry, immediately following the annual convention, the results of which need no further elaboration.

We are unofficially informed that the Commission has approved the conference rules essentially as presented. A complete report will shortly be released to the industry, showing the classification of the rules in Groups I and II, the first showing such rules as are violations of existing law and the second being what are termed expressions of the trade.

Accompanying the report of the Commission, which will be sent to every producer in the industry, there will be an acceptance form. This form should be immediately signed and returned to the Commission.

As an industry, we have publicly declared our intention of making an earnest and sincere effort to remove those trade practices which we recognize as being unfair and uneconomic. The first tangible proof of our sincerity of purpose will be reflected in the proportion of the industry which signs the Commission's Acceptance Form. There would seem to be no reason after having gone this far why substantially the entire industry will not promptly indicate to the Commission its intention of subscribing to the rules. It is confidently expected that such will be the case, thus marking the first constructive step towards removing from the industry the heavy burden of unfair and uneconomic practices.

New Hampshire to Spend $7,000,000

GOVERNOR Chas. W. Tobey and his council have approved the State highway department budget calling for the expenditure of $7,018,000 in 1930, according to an announcement by the Governor.

The Governor also announced that figures submitted by the department showed a surplus of $1,057,122, which will enable the State not only to complete the trunk line system laid out for this year but to add materially to the program calling for 50 miles of trunk line reconstruction.

Highway Construction

AFTER six weeks in conference, the federal aid highway authorization bill making available a total of 125 millions of federal funds for aid in the construction of primary highways, has been reported to the House and Senate from conference, and has passed the House. Early passage in the Senate is indicated.

The conferees disagreed on a Senate amendment written into the bill on original passage, increasing the amount of federal aid per mile from $15,000 to $25,000. An agreement was finally arrived at on a compromise which retains the $15,000 per mile maximum with the proviso that when any state has completed its original 7% highway system the maximum for subsequent federal aid per mile may be increased to $25,000. This bill represents an increase of $50,000,000 federal aid for highway construction over previous authorization of $75,000,000 per year.

When the measure was under consideration by the House Committee on Roads a special presentation committee representing the National Chamber appeared before the House Committee and presented the views of the National Chamber adopted at the 17th Annual Meeting, favoring increased authorization for this purpose. About ten days ago Mr. Butterworth, on behalf of the Chamber, and Mr. Barnes, on behalf of the National Business Survey Conference, addressed the conferees, stressing the advisability of settling the controverted issue, pointing out that delay in the final passage of the authorization measure was likewise delaying actual construction undertakings in a number of the states, thereby militating against the national business stabilization program.

It is estimated that funds made available by this bill being matched by like funds in several states where highway construction is in contemplation for the year, will represent employment for approximately 100,000 men at current prevailing wage rates, for at least seven months. It means, moreover, that actual construction work on projects in five mid-western and southwestern states can be under way in late July or early August.

The passage of this bill likewise clears the way for consideration of other highway measures, in particular those authorizing appropriations for the construction of forest highways.—*The Week's Work,* March 29, 1930.—U. S. Chamber of Commerce.

Stone Sand—Its Successful Use and Characteristics

(*Continued from page* 13)

factory workability. Others used the regular specification mixes and seem to have little difficulty in making a smoother concrete without undue labor. The testing laboratory of the Pennsylvania State Highway Department has maintained that this workability factor is such that they cannot permit the use of our sand. The big idea with them is daily yield of completed road. They think the contractor will be held back if he uses a sand that requires any extra labor in finishing. It has not been the experience of contractors laying concrete roads in the cities of Bethlehem or Allentown that any extra labor is required with our sand. The finish is hard and even, although it has a roughness that adds materially to its non-skid qualities. The road rides comfortably and wears exceptionally well. There seems to be no measurable wear from year to year on streets laid with our sand, even under the heaviest traffic.

It is our thought that a satisfactory market can be developed for this sand by persistent citing of the facts to engineers and architects. Frankly we have had little difficulty with contractors. Our prices are good and they seem able to get a job that is satisfactory to their customers with our sand. We believe we should go on developing this trade and that it is profitable for us to do so. We are advertising this material and hope to see a continued growth of its use. I have some samples of our advertising matter that anyone interested may inspect.

There seems to be little left for me to say. We believe the squeal should be saved when we butcher a pig and that there should be no waste piles of unmarketable material in a quarry.

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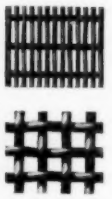

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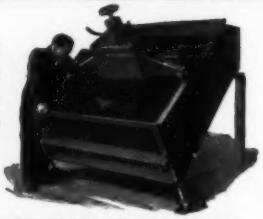

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WOVEN WIRE SCREEN

Motor Registrations Pass 25,000,000 Mark

REPORTS from state registration authorities to the Bureau of Public Roads, U. S. Department of Agriculture, show a total of 26,501,443 motor vehicles registered in 1929. The States and the District of Columbia collected in license fees, registration fees, permit fees, fines, etc., the sum of $347,843,543.

The registration figure includes passenger automobiles, taxis, busses, motor trucks, road tractors and trailers, and motorcycles, and represents an increase of 2,008,319, or 8 per cent over the 1928 figure. The total fees collected represent an increase of $25,213,518 over the 1928 figure. After deducting $24,505,737 for collection and miscellaneous purposes, the balance of $323,337,806 was applied to highway purposes, $223,292,969 to State funds, $66,861,364 to local funds, and $33,183,473 to State and county bond funds.

The ten states having highest registration figures are: New York, 2,263,259; California, 1,974,341; Ohio, 1,766,614; Pennsylvania, 1,733,283; Illinois, 1,615,088; Michigan, 1,395,102; Texas, 1,348,107; Indiana, 866,715; New Jersey, 832,332; and Massachusetts, 817,704.

In percentage gain, the District of Columbia and New Mexico each show 19 per cent. Nevada reports a gain of 16 per cent, Arizona 15 per cent, and Utah, 14 per cent. Four states, Georgia, Maryland, Massachusetts, and Tennessee, each show a gain of 12 per cent, and three states, Michigan, Montana, and Texas each report an increase of 11 per cent. California, Idaho, Kentucky, New Jersey, and Washington each show a gain of 9 per cent.

Construction Bill Sent to President

CONGRESS sent to President Hoover, March 28, for signing the Elliott-Keyes $230,000,000 public building bill (H. R. 6120), providing a nation-wide construction expansion program.

The public building bill which increases authorizations within the District of Columbia by $115,000,000 and in the rest of the Nation by the same amount, was messaged to the Senate during the 4-minute session, March 28, with the announcement that the House had accepted the Senate amendments. It was immediately signed by Vice President Curtis and in the course of the usual routine left for the White House within a few hours.

Flexible Steel Lacing Company Announces New Hinge Pins

WE have just received an announcement from the Flexible Steel Lacing Company, one of the advertisers in the *Journal*, which should be of interest to our readers, and it is quoted in full as follows:

We can now supply sectional steel rocker hinge pins for No. 15, and a new type corrugated wire hinge pin for Nos. 00 and 1 Alligator Steel Belt Lacing.

From time to time we have had complaint that the rawhide pins for Nos. 00, 1 and 15 were not entirely satisfactory under damp or wet conditions. The new pins have proven their superiority in extensive trial tests and we feel that we can, with full confidence, recommend their use.

On and after March 1st, 1930, boxes of Nos. 00 and 1 with the corrugated wire hinge pins, and all boxes of sizes 15 to 75 inclusive, with sectional steel rocker hinge pins, unless orders definitely call for rawhide pins.

We can and will supply as before rawhide pins with all sizes up to and including No. 45 without any additional cost, if and when ordered.

Unless a preference is indicated by letter or noted on individual orders, we will understand that you approve the proposed changes.

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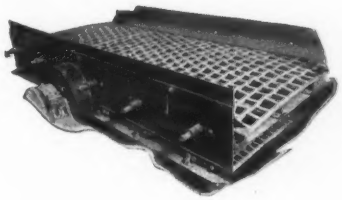

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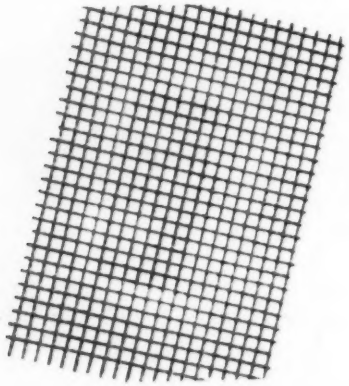

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Trade Association Activities in the Development of Ethical Standards

(*Continued from page* 11)

practices not unlawful per se, it has been in the public interest. The codes have been written in the open and in the presence of government officials, and these factors doubtless have exercised a restraining influence. The Commission has made it impossible for one group to organize against another because it will not conduct a meeting unless all members of the industry have been notified. The Commission has rejected resolutions not in harmony with the law or which it believed would work a hardship on the public. If it be objected that the Commission is not qualified to pass on the intricate questions involved, we answer that that is no reason why it should not continue to do the best it can until a better equipped agency is provided.

To sum up, I believe that resolutions looking to the protection of the public would have been less prevalent and selfishness would have played a greater part in the hundred codes written under the supervision of the Commission had they been adopted by the several industries acting alone and in secret.

IV.

A question has been raised as to whether industry codes of the kind we are now considering are ethically adequate. In other words, is it the purpose of such codes merely to serve industry, or is the public interest properly taken into account? The question may be resolved in the affirmative by disregarding Rotarian abstractions concerning "service" and bearing in mind that the sole and legitimate end of commercial endeavor is profit.

These codes may and generally do have for their immediate purpose the protection of the public against fraudulent practices, inferior products, discrimination, etc. But the ultimate purpose and the one which influences their adoption is to hold the entire industry to certain standards so that each member may go about his business of making money—more money than ever, he hopes—untroubled by the fear that his competitors may secretly revert to former "unethical" practices and thus gain a competitive advantage over him. The theory is that we must all be ethical, or unethical, and prepared to meet our competitors on whichever ground they choose. The object is not service to the public, but benefit to the industry and the individual members thereof.

The realization of a profit being the legitimate and ethically sound purpose of all commercial activity, it

would seem that the adoption of all fair and lawful means for the furtherance of that purpose would have a like sanction. The antitrust laws are a limitation on the natural rights of the citizen; and while he is in duty bound to respect them, he is under no obligation to yield any more of his right than the statutes demand. If it appears essential to his prosperity and well-being to conduct his business close to the statutory line, that is his privilege and there would seem to be no just ground for criticism. So long as his conduct is otherwise unexceptionable, he is not required to more than obey the law. We have not been so successful in curbing actual law violations that we can turn our guns on near offenders or those who merely stray into the twilight zone.

Whilst the ultimate purpose of these codes is benefit to the industry and its members, the result often is to greatly elevate business standards and increase the service rendered the public. The associations usually have the advice of competent counsel and generally avoid the measures which the law forbids. Price fixing, division of territory and the other indicia of law violation have been discarded. That measure of stabilization which the law allows is achieved by the voluntary exercise of an intelligent self-restraint by the individual members. The public does not begrudge the success which progressive industries have attained in this way. It is only when the public feels that it is being extorted or oppressed by the unified tactics of an industry that it complains. It will be time enough to halt this form of trade association activity when, if ever, that condition shall arise. It is to be hoped that the Government will not resort to Volsteadism in dealing with the delicate relations of industry.

As previously indicated, it is not necessary that the ultimate purpose of a code should be wholly unselfish. Morality is no less commendable because prompted by self-interest. The ancient maxim that honesty is the best policy really smacks of commercialism. One encounters true disinterestedness only in those who have retired from business. The test, therefore, is whether the advantages to be gained by the industry are fairly balanced by the elevation of standards and benefits to the public. If there is an honest effort to arrive at a basis of right action, that effort is not to be condemned because it is made in the hope of reward. Judged by these standards, the majority of modern business codes may be said to be ethically adequate.

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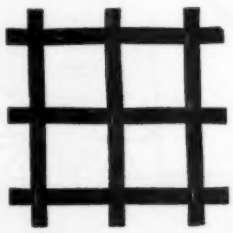

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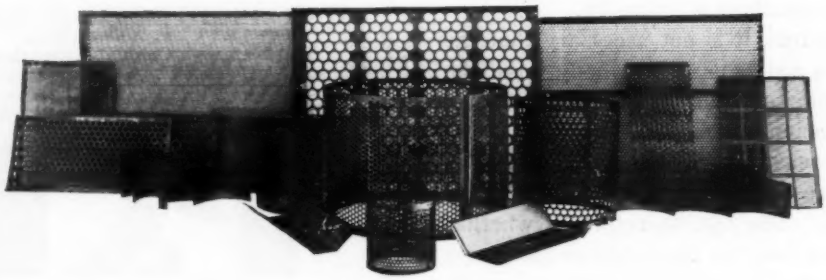

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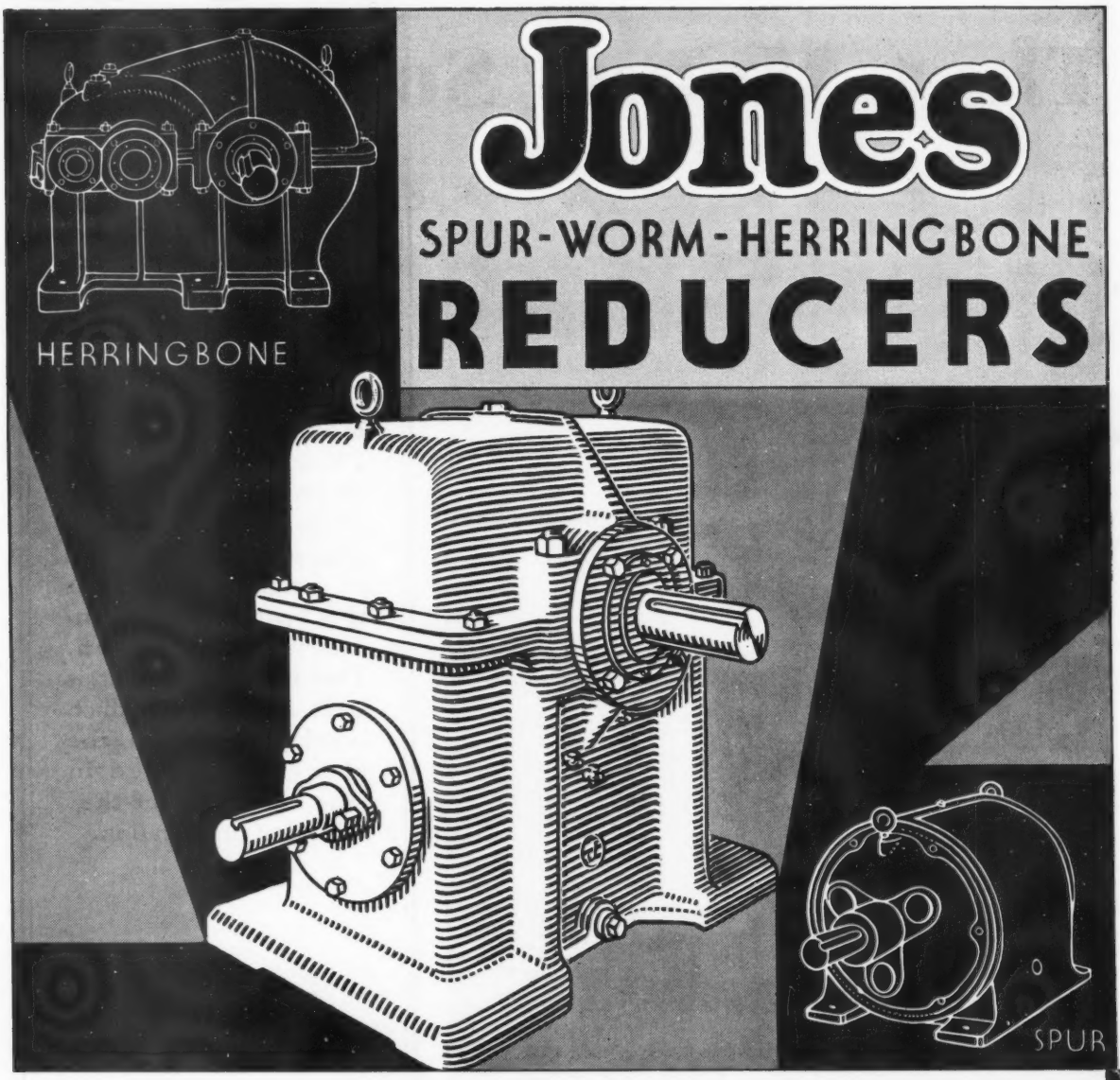

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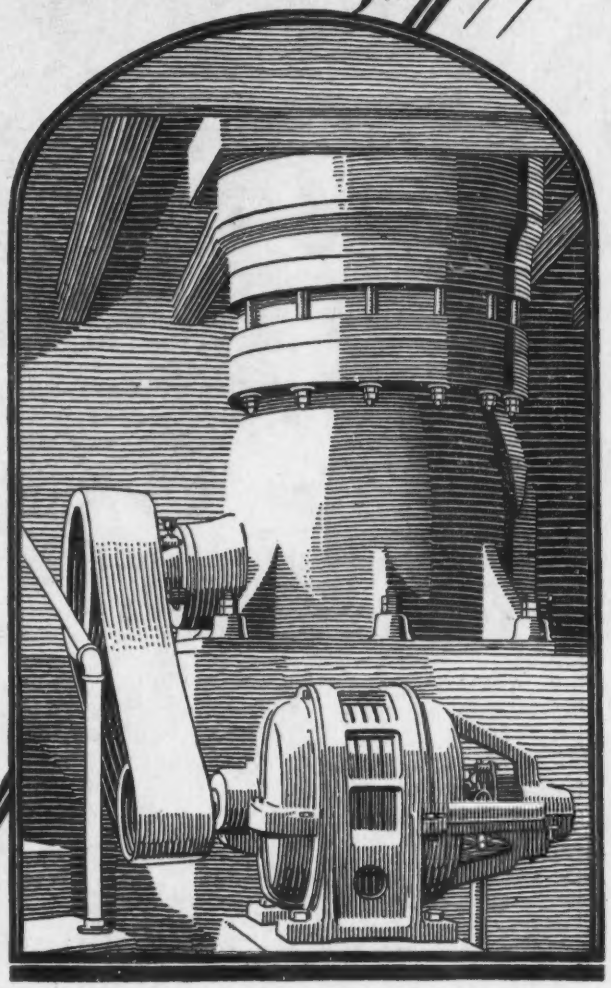

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